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## A CONTRIBUTION TO MUSEUM TECHNIQUE.

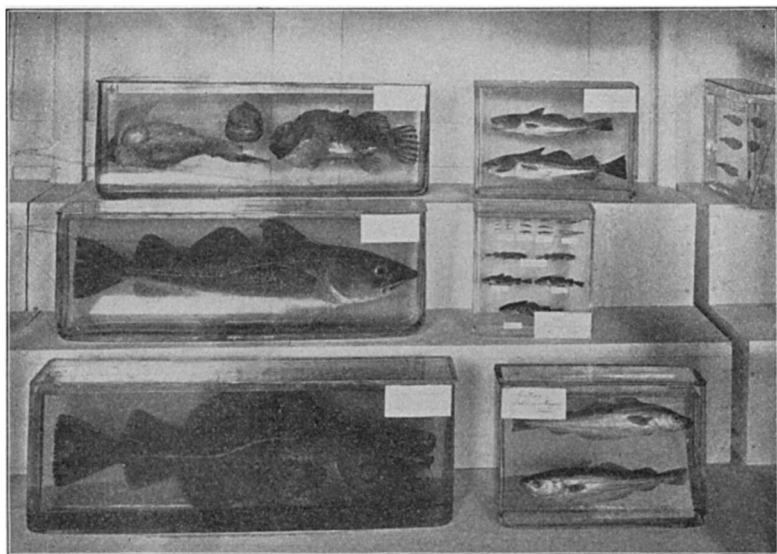
S. E. MEEK.

To exhibit fishes properly in a museum has been no easy task. Many methods have been devised, but none have as yet given universal satisfaction. Land animals, such as mammals, birds, reptiles, etc., are mounted and arranged in cases according to their natural order, to show relationship, or they are mounted in groups illustrating some of their habits and natural surroundings. These methods have received universal approval. With fishes the case is quite different. To mount them is difficult, and in most cases unsatisfactory, while many of the smaller soft-rayed fishes cannot be mounted. Painted plaster casts, or casts made of other material and painted, are used in some museums. In case nothing better can be had, these serve a good purpose and are especially desirable when a collection is to be exhibited at different times in various places. They are simply representations, and do not meet the desire of the visitor as do the real fishes themselves. A mounted fish is "a fish out of water," a fish robbed of his natural surroundings.

Three years ago we began some experiments in this museum to devise a metal case or vessel with a plate-glass front in which we could exhibit fishes in alcohol in a horizontal or natural position. A joint between the metal vessel and the plate glass, which would hold alcohol, and which would compensate at any temperature for the unequal expansion of the plate glass and metal, was devised by Mr. Wines, our building superintendent. Under his direction a vessel was made in December, 1898, with a plate-glass front of 18 by 36 inches. Nine species of sunfishes were placed in this vessel, and it was filled with 70 per cent alcohol, and put on the wall of one of our exhibition rooms. A few weeks later another case of 14 by 32 inches was made, and in it was placed a large blue-black trout from Lake Crescent,

Washington. These two cases have so far held satisfactorily, having been subjected to temperatures from 20° F. to 90° F. Two smaller cases put up at the same time have also proved very satisfactory.

In 1899 Dr. A. B. Meyer, director of the Natural History Museum of Dresden, made a tour of this country to study our museums and scientific institutions. It was my pleasure to escort him through the department of zoölogy in this museum. I called his attention to one of these cases and he remarked, "Very



good, but I like our method better." He kindly called my attention to an article, "Ein Beitrag zur Museumtechnik," by Dr. Max v. Brün, published in the *Abhandlungen aus dem Gebiete der Naturwissenschaften* (Bd. XIII), herausgegeben vom Naturwissenschaftlichen Verein in Hamburg, 1895. As this article is not easily accessible to all who are interested in the exhibition of fishes, I give here an abridged translation of it.<sup>1</sup>

The zoölogical museums are constantly progressing in their efforts to acquaint the public with the animal world by means of life-like representations. Those animals which are robbed of their natural appearance, in a greater or less degree, by insufficient

<sup>1</sup> Published with the permission of Dr. Brün.

methods of preservation and preparation, are gradually being replaced by properly prepared material, so that museums are constantly asking less of the fancy or imagination.

The problem of preserving natural colors in alcoholic specimens is still unsolved, and yet the impressions which animal forms make on the eye, and through it on the understanding, depend much on color. It is not so much the task of our museums to preserve the natural color of an animal as to give it a lifelike appearance after the color has faded or has been lost. If for exhibition purposes we do this properly, our methods need not be questioned. To represent absolutely true to nature an individual specimen, is in most cases as impossible as it is unnecessary; for even in nature the individuals of any species are not all made according to the same mould, but they differ from each other within certain limits, not less in color than in other characteristics. The problem of preserving natural colors is reserved for preserving liquids, as Wiese-liquid, which by means of its chemical action seems well adapted for this purpose.

Preceding the opening of the Natural History Museum of Hamburg, it was my wish so to exhibit fishes that they should appear as lifelike as possible. The methods known to me up to that time did not appear favorable, so I began to think of something new. I did not believe fishes should be exhibited in a dry state, — *viz.*, embalmed or stuffed, — nor in tall bottles, standing on head or tail, but that they should be in a horizontal position, seemingly swimming in a medium representing water.

This was attained by means of oblong glass boxes filled with alcohol. It was then observed that the colors which gave the fish a true natural appearance were absent; this was to be helped only by painting, and accordingly an attempt was made with water colors which led to satisfactory results. It has so met the favorable judgment of visitors and professional men that I venture to believe myself in a position to commend this method as worthy of imitation.

In Bergen, Norway, the entire fish fauna has been set up in this way, and is very satisfactory. This method is also in use in the British Museum, as well as in German museums.<sup>1</sup>

The method consists in painting the fish, preserved in alcohol, on one side with water colors, as nearly natural as possible; and then

<sup>1</sup>The paragraphs in smaller type are from letters written to the author by Dr. Brün.

fastening it in a horizontal position by means of gelatin to the wall of the glass box, which is later filled with alcohol. A fish thus successfully prepared appears, to the visitors at least, as a living fish in water. Its lifelike appearance is much improved in the proper painting of the eye, which is not at all difficult. These water colors are durable in alcohol only when they are carefully selected, as has been proved by four (now ten) years' experience. A fish thus completed needs no repairing for some time. While in a general way this method can be recommended, yet in a few instances it may not work, especially when we are dealing with forms that have a bright, sparkling appearance, such as goldfishes. In such cases the Wieseli-liquid seems to promise good results. A large goldfish preserved in this liquid for a period of two (now eight) years, though kept in the dark, has lost none of its brilliancy and beauty of color.

The using of oblong glass boxes is more expensive than glass bottles, but when we are dealing with a native fish fauna with comparatively few specimens of considerable size, this evil need not be permitted to play a large part. It is a fact that the mechanical possibilities of producing sufficiently large glass boxes for an available price are limited. The largest glass boxes prepared for this museum are 70 cm. long, and cost 24 marks each. Because of this, only the smaller specimens of the larger species, such as salmon and catfishes, can be easily exhibited. Very large specimens of these can be shown along with the smaller ones, either as mounted specimens or plaster casts, or they may be exhibited in glass boxes, made of glass plates cemented together.

The German marine exhibit in 1896 afforded me an opportunity to demonstrate the fact that these glass boxes with their contents could be easily transported from one place to another. Besides some small ones, the large glass boxes containing the salmon and the lamprey were taken from Hamburg to Berlin and returned in fine condition. The transportation was by boat on the Elbe, but, being taken to and from the boat by wagon, they were subject to considerable jarring.

The task of putting up one of the above-mentioned fishes may be divided into three parts: (1) preparation and preservation; (2) painting; and (3) setting up in the glass boxes.

(1) As the fish must be presented in a swimming position in the glass box with parallel walls, it must be preserved as perfectly as possible. In selecting a specimen one must pay special attention to form, color, proper size. Most of the fishes found in the markets are injured about the mouth, fins, or scales. Pretty badly injured

fins can be repaired. It is always best to select fishes to be mounted at the place of capture, and thus avoid the injuries occasioned by fish dealers in frequently throwing fishes from one vessel to another.

As only one side of the body is exhibited, it should be the better one, though as far as possible, for sake of uniformity, the same side of each should be presented to the visitor, as in my opinion it does not make as good an impression when some fishes are turned to the right and others to the left.

It is advisable to keep the live fish for some time in an aquarium, and make a study of its coloration. Then kill the fish in a 10 per cent solution of alcohol.

In using strong alcohol the mucous layer on the fish becomes too much hardened and cannot be removed.

After one half hour or so the mucous layer can be removed by means of a brush. Next lay the fish on its side in a shallow vessel, the bottom of which is lined with wax, and put on it some stronger alcohol. The fins are then spread, and held in position with insect needles. The torn fins are mended with fine silver wire, which is later removed. After the fish is in its proper position it is hardened by the gradual strengthening of the alcohol; the time required for this depends on the size of the fish, one of about two pounds' weight requiring about six days to bring the alcohol to 75 per cent.

In successful cases the form of the body is scarcely changed at all, and the eye fills its cavity as when the fish was alive. It is well, in case of larger fishes, to inject some alcohol into the vent after killing and to close it with cotton. The intestine should first be pierced, also the inner muscles of the body, with a fine scalpel, that the injected alcohol may fill the body cavity and more easily enter the flesh.

Externally the fish should not be injured in order to make the alcohol penetrate more rapidly, since where injured the fish would not get dry enough to paint, and injury to the farther side would interfere with fastening the fish to the gelatin. Should the belly still sink to an interfering extent, the proper roundness can finally be secured by stuffing it with cotton.

Later I have used formaldehyde 1 : 20, which I believe is to be commended to keep the body shape well. The fish is first killed in weak alcohol, then hardened in formalin, and later transferred to alcohol for permanent preservation. With the formalin treatment the scales of some species come off too easily.

(2) The painting of the fish faded by use of alcohol. For this purpose I have used water ground color and occasionally some marine blue. A few kinds of these colors are, however, to be avoided; in the first place, those containing lead, such as white lead and chrome yellow. The alcohol in which a fish has been for some time finally becomes somewhat acid, and at the same time the process of decomposition forming  $H_2S$  turns the colors containing lead dark or black. That is the way I was served in several cases; the pretty white belly of the fish finally appeared quite blackened. Chemical examination of the alcohol showed that there was present .034 per cent of free acid, supposed to be acetic acid (.348 gr. to one liter of alcohol). Under these conditions silver and brass bronze, usually appearing so durable, turned dark. Experiments with  $H_2S + H_2O$  resulted in great durability of the same, but changed immediately after any trace of acid was added.

Aluminium bronze remained unchanged, even after the addition of considerable acid. Therefore one should use permanent white fine aluminium bronze and clear gold bronze. For use these are worked with a little liquid gum arabic.

Dr. W. G. Ridgwood has carried out in the British Museum very thorough tests for the most varied colors, as to their permanency in alcohol and sunlight, and has found decided differences.

The method of painting is as follows. The hardened fish is laid on a suitable surface. It is best to color the trunk and head first. In the mean time the fins must not be allowed to dry. The eye should be kept moist before and after painting, else these parts will dry out too quickly and shrink. If after a few minutes the body seems sufficiently dry, then one may begin with the painting, which after a little practice may be done without any special artistic ability. The paint cannot be applied as perfectly as it can be on paper, yet still in a sufficient degree to obtain the desired effect. This is most easily done in case of small scaled fishes, for example the tench; in other cases patience and practice lead to the goal. The process of painting is delayed very much because of one's being occasionally compelled to moisten the parts with alcohol, in order to observe the action of the colors, and eventually to change the tone of the same.

Because of the escape of fat or similar substances, the opercle, and many scales, and fin rays occasionally do not seem to take on the paint. These parts I have endeavored to cleanse with benzine. It

would perhaps be best to give them a coat of ox gall, which is used in painting on glass. The pupil should be colored a bluish black and surrounded with a golden circle verging into the iris; to the iris one can reproduce the niceties of its natural appearance, namely, its silver or gold glint, red circles and spots, black stripes, dots, etc. As soon as the paint is dry the eye should be moistened; otherwise it would sink, though a little sinking is hardly noticeable when the fish is put in alcohol.

Injured fins must be repaired before painting, which may be done by pasting on underside small pieces of silk paper with a thin solution of gelatin. The repaired places must be carefully dried before painting.

(3) The fastening of the fish in the glass.

The glasses used in our museum are blown oblong, with parallel walls. There are three special sizes produced by the glass factories of Gundlach & Müller of Altona-Ottensen. Their comparative sizes in centimeters and their prices, with 5 per cent discount, are as follows :

LENGTH.	HEIGHT.	DEPTH.	PRICE.
35	20	9	8 marks
50	25	11	11 “
70	30	14	24 “

These glasses are unground: those with polished face are more expensive, but appear also much more elegant. The firm already mentioned has filled many orders for such glasses, and has of course much experience. Transportation of the same, even of the largest glass boxes, has been successfully made to America without material loss.

These glass boxes are closed with sheets of glass about 3 mm. thick and the edges ground to correspond to the thickness of the walls of the box, to which they are securely fastened with gelatin.

The closing of glass boxes, especially the larger ones, is not easy. When the collection is to stand some time undisturbed it is well to close the larger ones by simply covering with the glass lid. As the alcohol slowly evaporates it may be replaced. To open the glass boxes which have been closed with gelatin, it is better to cover the lid with layers of blotting paper and these with a wet cloth. After some time, say over night, the gelatin is softened, and the cover can be released with a little care.

In order to fasten the fish in a horizontal position in the glass case, it should first be laid on its broad side in the manner in which it is to be fastened in the glass. The tail should be supported with a piece of cork, or something of the kind, which is covered with



gelatin. Remove the fish and place where the head is to lay a layer of pretty stiff gelatin liquid, also place some on the cork ; then lay the fish, previously well dried, on its unpainted side in its proper position in the glass. Soon the gelatin will be sufficiently hardened to permit the filling of the glass box with alcohol. If necessary, a hot knife may first be applied to the gelatin to fasten the fish securely to the glass. An eight-pound salmon fastened in this way has remained unchanged. The visitor sees nothing of this manner of fastening.

As I have in the foregoing only spoken of the painting of fishes, I should here like to say that other objects to be kept in alcohol may be treated in the same manner, — reptiles, amphibians, invertebrates, anatomical preparations, plants, etc.

In our museum at Hamburg there are numerous painted objects of this kind from both fresh and salt water, and though very imperfectly painted, they have a lifelike appearance. Especially is this true of water plants.

Such objects as sponges, which should have a uniform coloring, and which will stand being in water for a little while, may be put into a watery solution of the color, where they quickly become impregnated with it.

Moulded glass vessels are not as perfect as they should be ; the surface is not exactly smooth ; besides, it is made more or less dim by being in contact with the mould. The glass is thicker at the center and gradually thins out toward the edges and corners. The side of an oblong moulded glass vessel is quite inferior to a similar surface of polished plate glass. It is not necessary that a vessel be made entirely of glass ; the top, bottom, two ends, and farther side may as well be made of any other suitable material. The side through which the observer must see the specimens cannot be too perfect.

A few years ago Mr. J. E. Benedict, of the United States National Museum, appreciating the value of a glass vessel whose sides (front one at least) are planes, experimented considerably, constructing vessels by cementing together sheets of plate-glass. To what extent he now regards this method as a success I am not advised. I never did believe his method received the recognition it deserved. It seems to me, however, that by using this method, the exhibition surface must necessarily be limited,

just as in the case of the cast-glass boxes. The idea of representing a fish in a museum in a fluid so that it "appears, to the visitor at least, as a living fish in water" is an excellent one. Following out this idea, our exhibition vessel partakes somewhat of the nature of an aquarium. A well-constructed aquarium needs but one glass side, and this side should be polished plate glass. It is necessary to make a joint between the material used and the plate glass which will not be effected by changes of temperature, and this presents no serious difficulties.

We have not tried the painting of fishes or fastening them in the vessel by means of gelatin. The use of round or oval glass bottles has been, within the past few years, quite universal. But both of these bottles are objectionable, because in them the fishes must stand on head or tail, and besides suffer more or less distortion. Among fishes are many peculiar and interesting forms, and this class of animals are as deserving of suitable methods of exhibition as are the other classes.

The time has certainly come when some method which will permit fishes to be placed in our museums as lifelike as possible, and one which will be economical and durable, will be much appreciated. If those who are interested in this question, and who have given it some attention, will publish the results of their experiments, it is possible that enough good features can be selected to discover the proper method.